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USAFSAM MULTIPURPOSE SUCTION PUMP.(U)
APR 78 H BUCHANAN, M J CHANDLER

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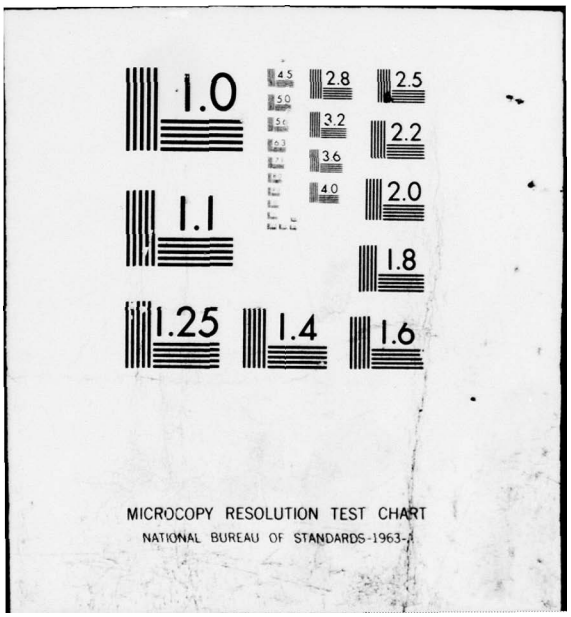
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LEVEL II

USAFSAM MULTIPURPOSE SUCTION PUMP

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April 1978

Final Report for Period July 1973-February 1976

USAF SCHOOL OF AEROSPACE MEDICINE
Aerospace Medical Division (AFSC)
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NOTICES

This final report was submitted by personnel of the Biomedical Systems Branch, Clinical Sciences Division, USAF School of Aerospace Medicine, Aerospace Medical Division, AFSC, Brooks Air Force Base, Texas, under job order 7755-21-04.

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This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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Aeromedical Evacuation

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

A multipurpose suction pump was designed at the USAF School of Aerospace Medicine to provide both intermittent (0-30 or 0-70 mmHg) and continuous (0-250 or 0-500 mmHg) vacuum from one unit for use on litter patients onboard multimission aircraft. The pump is portable, simple to operate, and may be powered from 115 volts AC, 50-400 Hz power; 12 and 28 volts DC, or from a self-contained battery pack. When operating, the pump will not interfere with navigational aids or communication equipment onboard the aircraft. → rep

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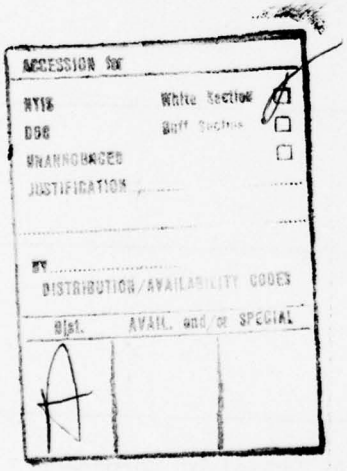
20. ABSTRACT (Continued)
Laboratory environmental tests indicated that the pump operated satisfactorily and complied with aeromedical operational requirements and with military standards. Two prototype pumps were fabricated: One was sent to the 9th Aeromedical Evacuation Squadron (MAC), Clark AB, RPI, for field testing; results indicated the pump met aeromedical evacuation operational requirements, although some pump modifications were deemed necessary.



USAFSAM MULTIPURPOSE SUCTION PUMP

Both continuous and intermittent suction is needed for patients being transported onboard C-141 and C-130 aircraft configured for aeromedical evacuation. In 1971, only one source was available for a suction pump that would provide both capabilities, and at that time, the price of the pump was considered too high for its use in the airborne environment. Reasonably priced suction pumps provided either continuous or intermittent suction capabilities; thus two separate pumps were needed to satisfy the needs of airborne patients.

In July 1973, a project was initiated to design a multipurpose (continuous and intermittent) suction pump that would satisfy the needs of the aeromedical evacuation system and meet Air Force safety specifications and regulations. Specifications required a multipurpose suction pump to operate from 115 volts alternating-current (VAC) power; 28 volts direct-current (VDC) aircraft power; 12 VDC ambulance power; and a self-contained 12-volt nickel-cadmium battery pack. The fully charged battery pack was to provide 90 minutes of operation in the continuous suction mode set at 200 mmHg vacuum. The pump was to have a power ON-OFF switch, vacuum gauge (0-760 mmHg), pilot lights, and circuit breakers. The collection bottle was to have a minimum capacity of 1500 cc, be made of plastic, and be protected from the adverse conditions resulting from rapid decompression (8,000- to 35,000-ft, or 2.4- to 4.7-km, equivalent altitude in 0.2 sec). It was to have a fluid-level trap, be easily cleaned, and be easily removed from the carrying case.

EQUIPMENT DESCRIPTION

The USAF School of Aerospace Medicine (USAFSAM) multipurpose suction pump and ancillary items are packed in an aluminum case 20 inches wide, 14 inches high, and 10 inches deep (Fig. 1). A carrying handle on top of the case and a handle at each end for securing the unit to the aircraft or for carrying purposes are provided.

The suction pump consists of three major components: a pump module, a 2,000-cc reservoir, and a carrying case (Fig. 2). A fluid trap is located on the left side of the pump module, and a 60 to 400 Hz power adapter is shown in the foreground. So that the case and equipment can be easily cleaned if spillage occurs, mountings in the carrying case were designed to permit easy removal of the components.

The suction pump was designed to be operated in the carrying case. As shown in Figure 3, all controls can be easily seen and manipulated.

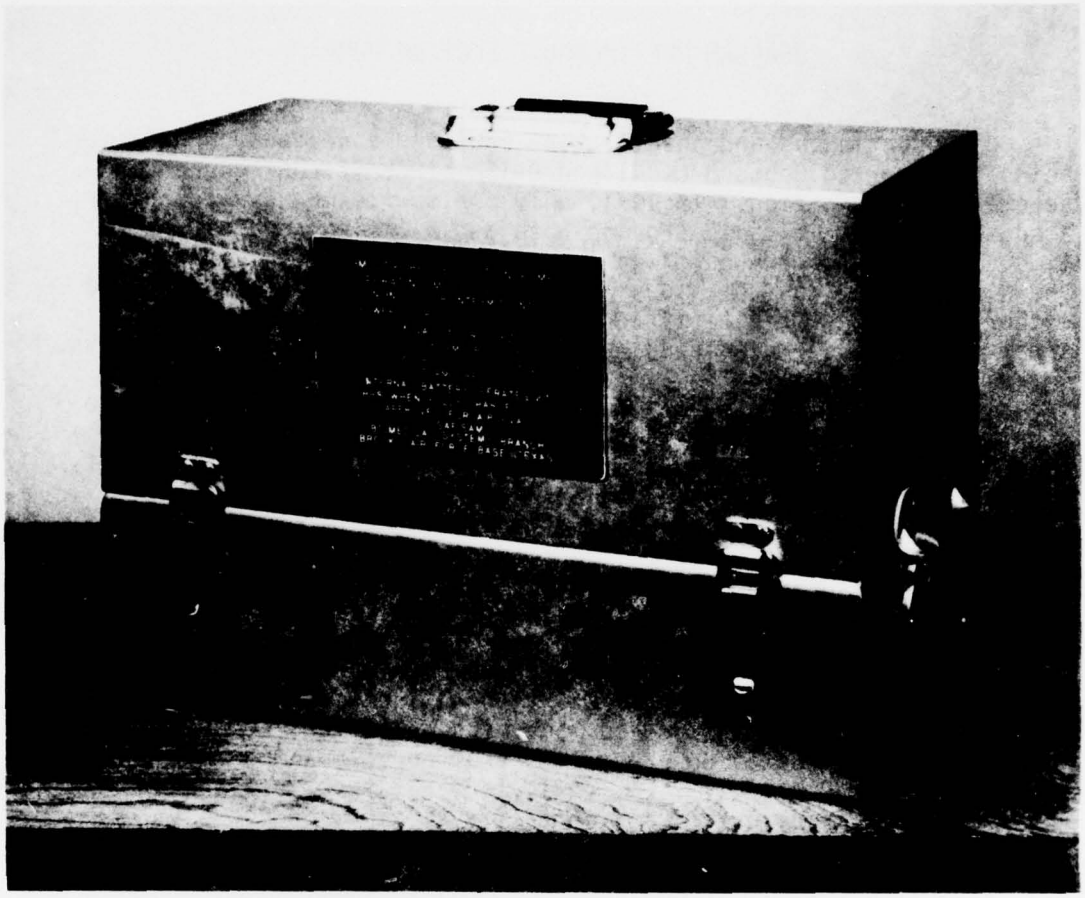


Figure 1. USAFSAM multipurpose suction pump in carrying case.

The clear plastic reservoir allows the fluid level to be readily observed, and the amount of fluid can be determined by the graduations on the side of the reservoir. The attached AC cable is for direct operation of the unit from 115 VAC, 50 or 60 Hz. By attaching the power adapter to the AC cable, the pump may be operated from the C-141 aircraft 115 VAC, 400 Hz power.

The lid of the carrying case has a storage compartment for extension cables, adapters, and power cables. Figure 4 shows the compartment containing one 25-foot extension cable for use with 115 VAC, 50-400 Hz; one 60 to 400 Hz cable adapter (for C-141 use); one 10-foot 12-VDC ambulance power cable; and one 10-foot 28-VDC power cable.

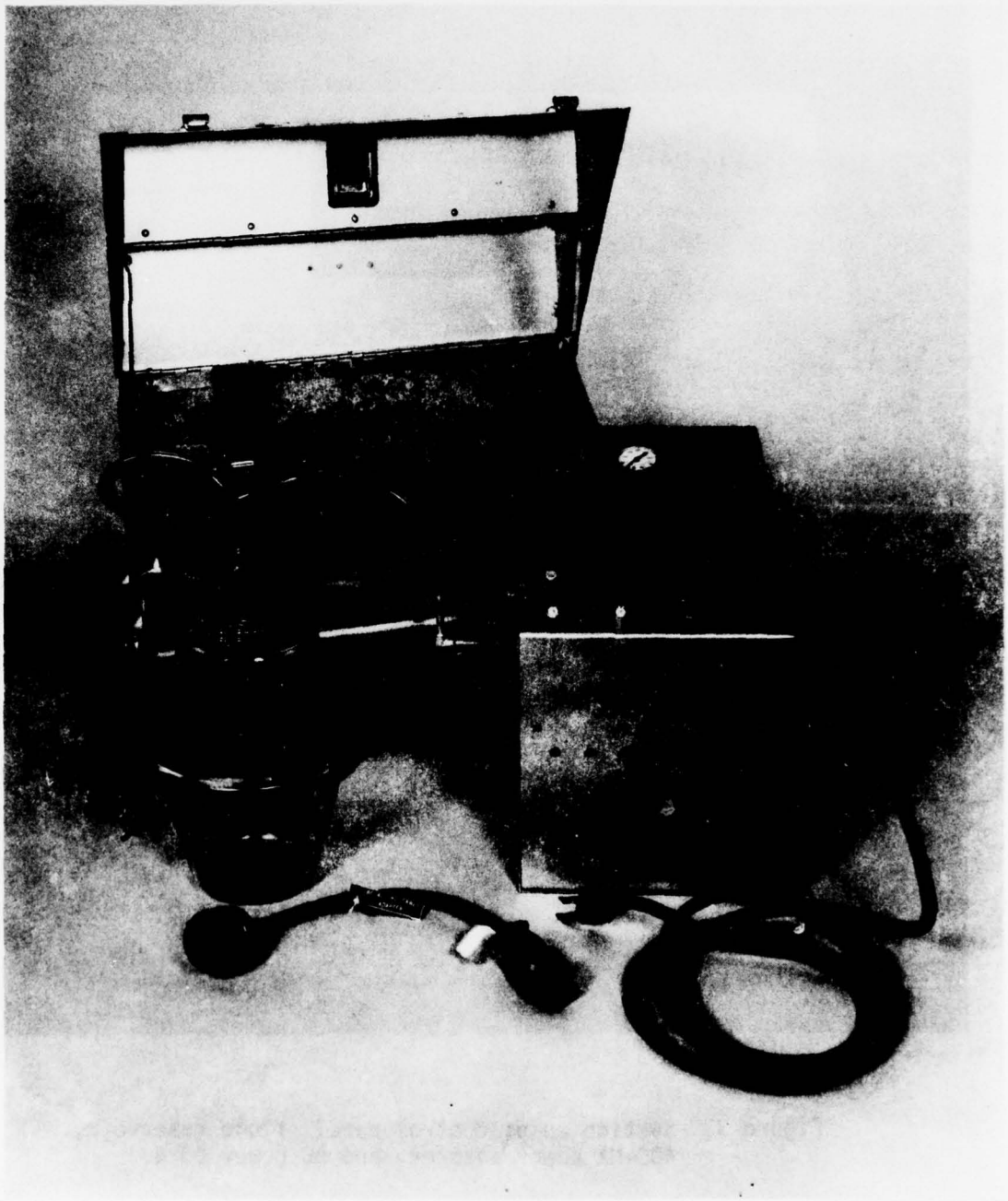


Figure 2. Pump module and reservoir removed from carrying case.

Figure 3. Suction pump; control panel, fluid reservoir, 400-Hz power adapter, and AC power cord.

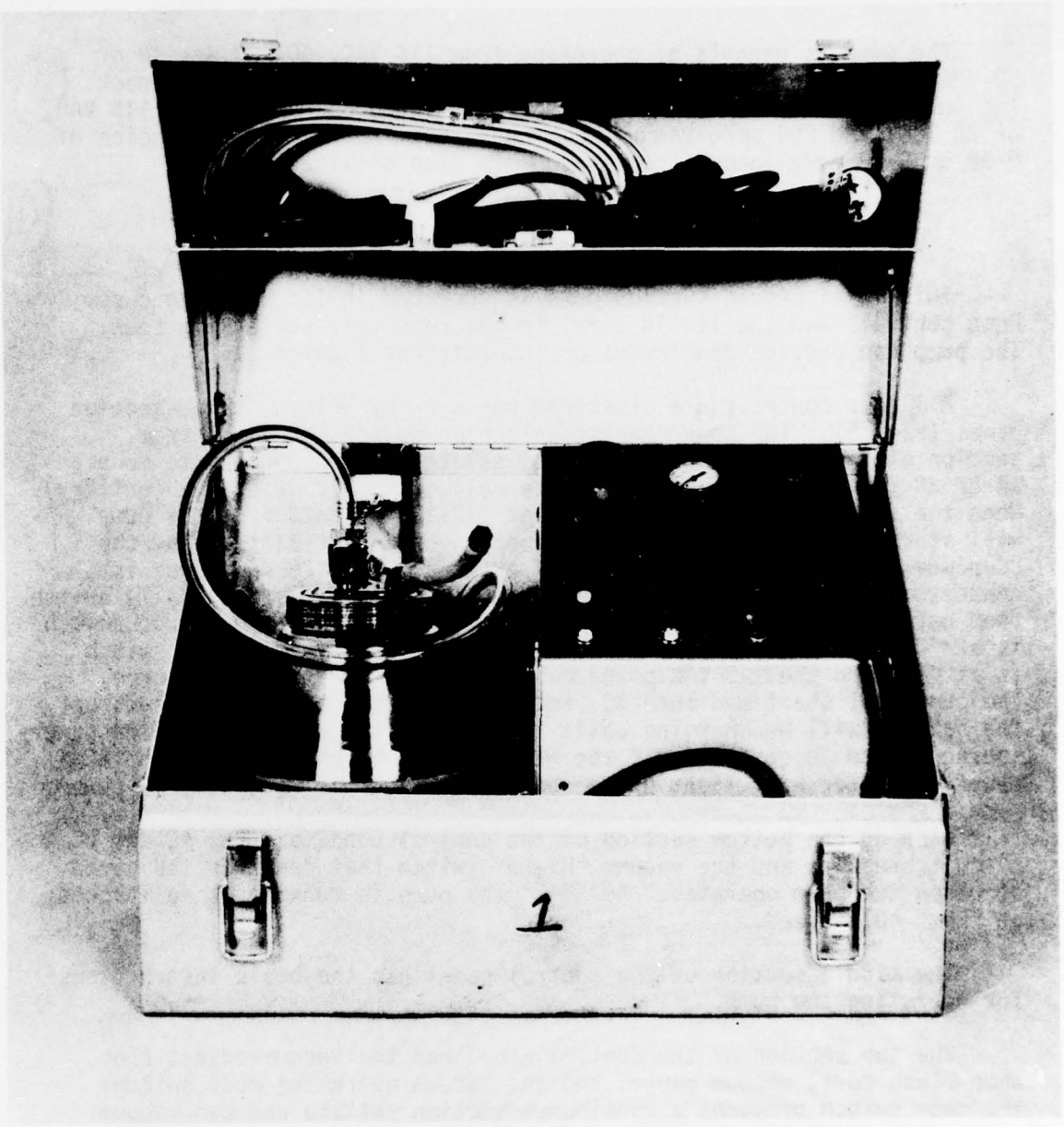


Figure 4. Suction pump storage compartment; extension cable, power adapter, and power cables.

The pump is capable of operating from 115 VAC, 50-400 Hz; 12 or 28 VDC external power; or from a self-contained 12-volt battery pack. The pump module can provide 500 mmHg vacuum when operating from 115 VAC or 28 VDC, and 250 mmHg vacuum when operating from 12 VDC. A choice of 0-30 or 0-70 mmHg intermittent vacuum is also provided.

EQUIPMENT OPERATION

This multipurpose suction pump is operated in its carrying case. Pump controls and the liquid level in the reservoir are easily seen. The pump can provide continuous or intermittent suction.

All pump controls are clustered on an 8- by 8-inch, three-section panel (Fig. 5). The power-source selection switch, on the bottom section of the control panel, permits selecting the appropriate mode: 12 or 28 VDC (external)/Battery (internal), Off, AC, or Charge (battery). When the power-source switch is set at "12-28 VDC/Battery," the pump will start operating from the self-contained 12-volt battery and the DC-power indicator will light up; if external 12 or 28 VDC power is connected to the 12-28 VDC receptacle, the pump will automatically switch from battery power to the external source. When the power-source switch is at "Off," all external and internal power is off. When the switch is at "AC" and the 115 VAC power cable is connected to an AC source, the pump will start and both AC- and DC-power indicators will light up; the battery will be charging while the pump is operating. When the power-source switch is on "Charge," the battery will be charging and the AC-power indicator will light up to show the charger is receiving AC power.

Also on the bottom section of the control panel are the AC and DC circuit breakers and the vacuum "Hi-Lo" switch that controls the speed at which the pump operates. At "Hi," the pump is running at full speed; at "Lo," half speed.

The middle section of the control panel has the basic instructions for operating the pump.

The top section of the control panel has the vacuum-adjust knob, pump-flush port, vacuum gauge, and the vacuum operating-mode switch. The mode switch provides a continuous-suction setting and two vacuum ranges for intermittent suction. When the operating-mode switch is set at "Cont," the vacuum range depends on the power source selected and position of the "Hi-Lo" vacuum switch, as follows:

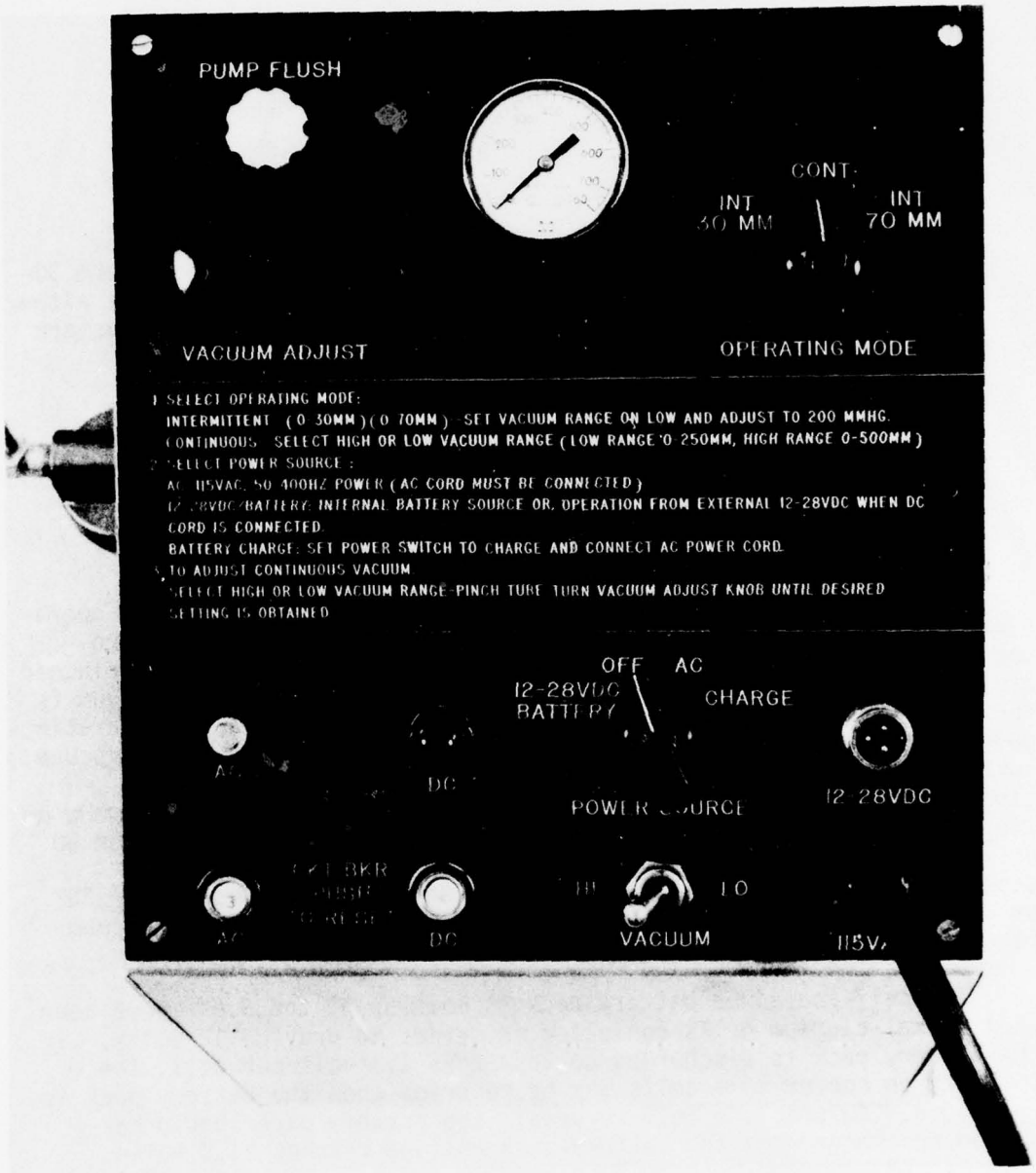


Figure 5. USAFSAM suction pump control panel.

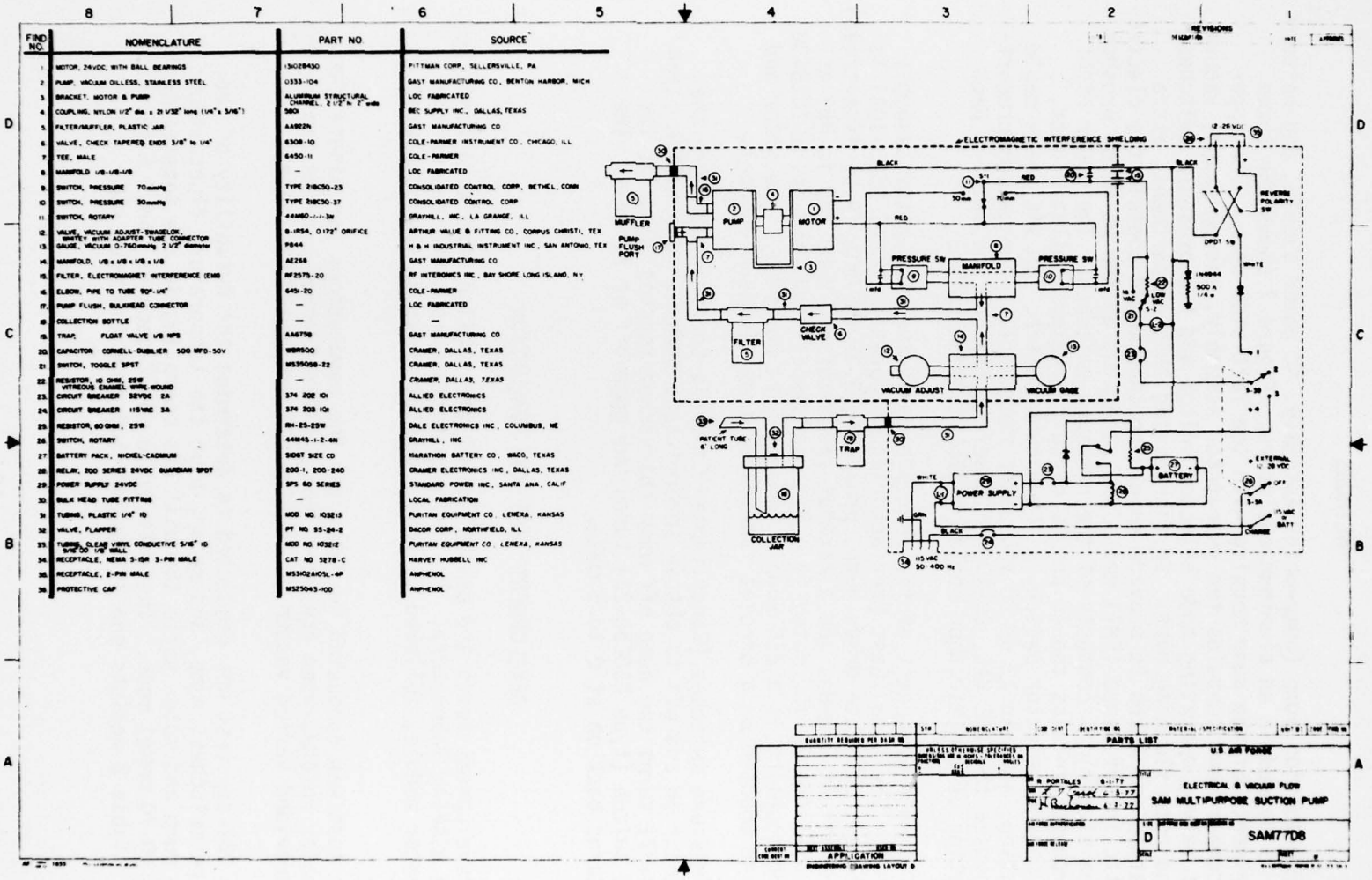
Power source	Vacuum setting	Vacuum (mmHg)
Internal battery	Hi	0-250
" "	Lo	0-105
External 12 VDC	Hi	0-250
" "	Lo	0-105
External 28 VDC	Hi	0-500
" "	Lo	0-250
115 VAC 50-400 Hz	Hi	0-500
" "	Lo	0-250

Neither power source nor "Hi-Lo" vacuum selection affects the intermittent-vacuum range except for the time required to reach the 30- and 70-mmHg end points. When the operating-mode switch is set at either 30- or 70-mmHg intermittent vacuum, the following "Hi-Lo" settings are recommended, depending on power selected:

Power selected	Vacuum setting
115 VAC, 50-400 Hz	Lo
External 28 VDC	Lo
External 12 VDC	Hi
Internal battery	Hi

Vacuum is adjusted as follows: Continuous vacuum--With the operating-mode switch set at "Cont" and with the power-source and Hi-Lo vacuum switches set appropriately, the patient suction line is "pinched closed" and the vacuum-adjust knob manipulated until desired vacuum is indicated on the vacuum gauge. Intermittent vacuum--With the operating-mode switch set at "Cont" and with the power-source and "Hi-Lo" vacuum switches set appropriately, the patient suction line is "pinched closed" and the vacuum-adjust knob is manipulated to obtain 200 mmHg on the vacuum gauge. The operating-mode switch is then set at either 30 or 70 mmHg. The intermittent mode is vacuum dependent, not time dependent: the pump will shut off when the vacuum reaches either 30 or 70 mmHg, depending on the setting, and will start when the vacuum reaches 5 mmHg.

The self-contained battery pack is made up of ten 3.0 ampere hour (AH) nickel-cadmium cells connected in series to provide 12 volts. If the battery pack is discharged to less than 1.1 volt per cell, the polarity on one or more cells may be reversed when the battery pack is recharged. To preclude cell reversal, the battery pack should be placed on charge when the battery-pack voltage reaches 11.0 volts. From a fully charged battery this 11-volt limit is reached in 2.5 hours when the suction pump is providing 200 mmHg of vacuum continuously. The limit will be reached in approximately 21 hours when the suction pump is operating on the intermittent mode. An electrical and vacuum line schematic of the pump is shown in Figure 6.



FIND NO.	NOMENCLATURE	PART NO.	SOURCE
1	MOTOR, 24VDC, WITH BALL BEARINGS	13028430	PITTMAN CORP., SELLERSVILLE, PA
2	PUMP, VACUUM OILLESS, STAINLESS STEEL	0333-104	GAST MANUFACTURING CO., BENTON HARBOR, MICH
3	BRACKET, MOTOR & PUMP	ALUMINUM STRUCTURAL CHANNEL, 2 1/2" h. 3" wide	LOC FABRICATED
4	COUPLING, NYLON 1/2" dia. x 21 13/32" long (1/4" x 3/16")	5801	BEC SUPPLY INC., DALLAS, TEXAS
5	FILTER/MUFFLER, PLASTIC JAR	AA9029	GAST MANUFACTURING CO
6	VALVE, CHECK TAPERED ENDS 3/8" to 1/4"	6308-10	COLE-PARMER INSTRUMENT CO., CHICAGO, ILL
7	TEE, MALE	6450-11	COLE-PARMER
8	MANIFOLD 1/8-1/8-1/8	—	LOC FABRICATED
9	SWITCH, PRESSURE 70mmHg	TYPE 21BC50-23	CONSOLIDATED CONTROL CORP., BETHEL, CONN
10	SWITCH, PRESSURE 30mmHg	TYPE 21BC50-37	CONSOLIDATED CONTROL CORP
11	SWITCH, ROTARY	44MBD-1-1-3N	GRAYHILL, INC., LA GRANGE, ILL
12	VALVE, VACUUM ADJUST-SWAGELOK-WHITEY WITH ADAPTER TUBE CONNECTOR	B-1RS4, 0.172" ORIFICE	ARTHUR VALUE & FITTING CO., CORPUS CHRISTI, TEX
13	GAUGE, VACUUM 0-760mmHg 2 1/2" diameter	P844	H.B.H. INDUSTRIAL INSTRUMENT INC., SAN ANTONIO, TEX
14	MANIFOLD, 1/8 x 1/8 x 1/8 x 1/8	AE268	GAST MANUFACTURING CO
15	FILTER, ELECTROMAGNET INTERFERENCE (EMI)	RF2575-20	RF INTERONICS INC., BAY SHORE LONG ISLAND, N.Y.
16	ELBOW, PIPE TO TUBE 90°-1/4"	6451-20	COLE-PARMER
17	PUMP FLUSH, BULKHEAD CONNECTOR	—	LOC FABRICATED
18	COLLECTION BOTTLE	—	—
19	TRAP, FLOAT VALVE 1/8 NPS	AA6758	GAST MANUFACTURING CO
20	CAPACITOR CORNELL-DUBILIER 500 MFD-50V	WBP500	CRAMER, DALLAS, TEXAS
21	SWITCH, TOGGLE SPST	MS35058-22	CRAMER, DALLAS, TEXAS
22	RESISTOR, 10 OHM, 25W VITREOUS ENAMEL WIRE-WOUND	—	CRAMER, DALLAS, TEXAS
23	CIRCUIT BREAKER 32VDC 2A	374 202 101	ALLIED ELECTRONICS
24	CIRCUIT BREAKER 115VAC 3A	374 203 101	ALLIED ELECTRONICS
25	RESISTOR, 60 OHM, 25W	RH-25-25W	DALE ELECTRONICS INC., COLUMBUS, NE
26	SWITCH, ROTARY	44M4S-1-2-4N	GRAYHILL, INC
27	BATTERY PACK, NICKEL-CADMIUM	SIOBT SIZE CD	MARATHON BATTERY CO., WACO, TEXAS
28	RELAY, 200 SERIES 24VDC GUARDIAN SPDT	200-1, 200-240	CRAMER ELECTRONICS INC., DALLAS, TEXAS
29	POWER SUPPLY 24VDC	SPS 60 SERIES	STANDARD POWER INC., SANTA ANA, CALIF
30	BULK HEAD TUBE FITTING	—	LOCAL FABRICATION
31	TUBING, PLASTIC 1/4" ID	MOD NO. 103E13	PURITAN EQUIPMENT CO., LENEXA, KANSAS
32	VALVE, FLAPPER	PT NO 55-84-2	DACOR CORP., NORTHFIELD, ILL
33	TUBING, CLEAR VINYL CONDUCTIVE 5/16" ID 9/16" OD 1/8" WALL	MOD NO. 103E12	PURITAN EQUIPMENT CO., LENEXA, KANSAS
34	RECEPTACLE, NEMA 5-15R 3-PIN MALE	CAT NO 5278-C	HARVEY HUBBELL INC
35	RECEPTACLE, 2-PIN MALE	MS3102A10SL-4P	AMPHENOL
36	PROTECTIVE CAP	MS25043-100	AMPHENOL

Figure 6. Electrical and vacuum line schematic of the USAFSAM suction pump.

METHODS

The suction pump (pump-motor assembly, AC power supply, and battery pack) is housed in an aluminum enclosure. Figure 7 shows the three compartments of the pump housing with the left side open. The upper left compartment contains the pump-motor assembly, vacuum gauge, vacuum-adjust valve, operating-mode selector switch and two pressure switches, and the pump flushing port. In fabricating this compartment, extra precaution was taken to provide shielding that would contain the electromagnetic interference (EMI) emissions generated by the DC motor brushes and the electrical contacts of the pressure switches. The upper right compartment contains the AC and DC circuit breakers, pilot lights, power-source selector switch, Hi-Lo vacuum switch, 115 VAC power-cable connection, and the 12 or 28 VDC power receptacle. The bottom compartment houses the 115 VAC, 50-400 Hz power supply and the battery pack consisting of ten Marathon sealed nickel-cadmium cells.

The main component of the vacuum pump is the pump-motor assembly (Fig. 8). The pump (Gast Manufacturing Corporation Model 0333-104) is an oilless, separate drive pump, providing 0.35 ft^3/min (9.91 liters/min) of free air at 0 mmHg, and a maximum vacuum of 500 mmHg (20 in Hg) at 3450 rpm. The 24 VDC motor is a Pittman Corporation Part No. 13102B430, and the coupling is a BEC Supply Company Part No. 5801. The motor and pump are mounted on a bracket fabricated from aluminum channel.

Pressure switches (Consolidated Controls Corporation) turn the pump motor on and off to obtain intermittent vacuum. One switch (type 218C50-37) turns the pump off when the vacuum reaches 30 mmHg; the second switch (type 218C50-23) turns the pump off at 70 mmHg. The pump turns back on at 0 to 5 mmHg.

DEVELOPMENT TEST AND EVALUATION

Development tests and evaluation of the suction pump were conducted in the USAFSAM laboratory. Preliminary tests were conducted on the pump-motor module, followed by environmental tests on the completed pump.

A test was conducted to determine the revolutions per minute the pump motor rotated when operated from different power sources and as the pump provided varied vacuums. Results are indicated in Table 1.

A 192-day test was conducted to determine the durability of the pressure switches, pump, and motor, plus the temperature fluctuations of the pump and motor while the unit was operating in the intermittent-vacuum (0-70 mmHg) mode. The duty cycle was 2 seconds "on," 5 seconds "off." Table 2 depicts one 24-hour period from the test run.

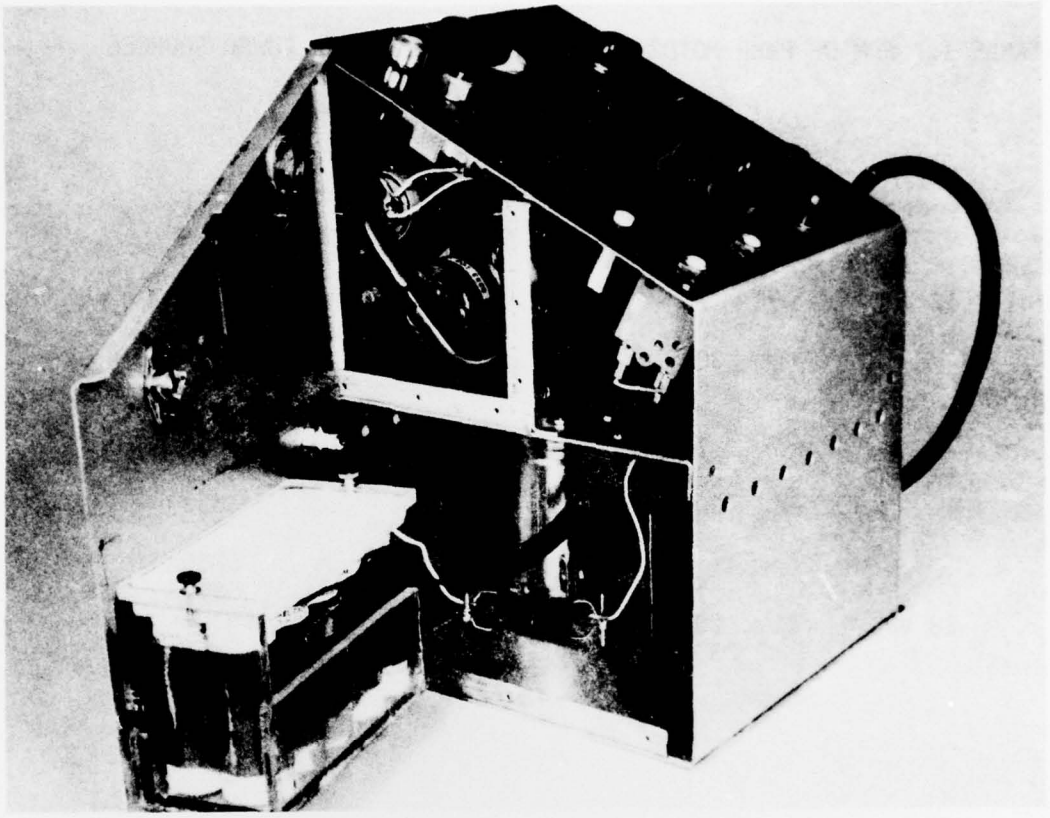


Figure 7. USAFSAM pump partially disassembled.

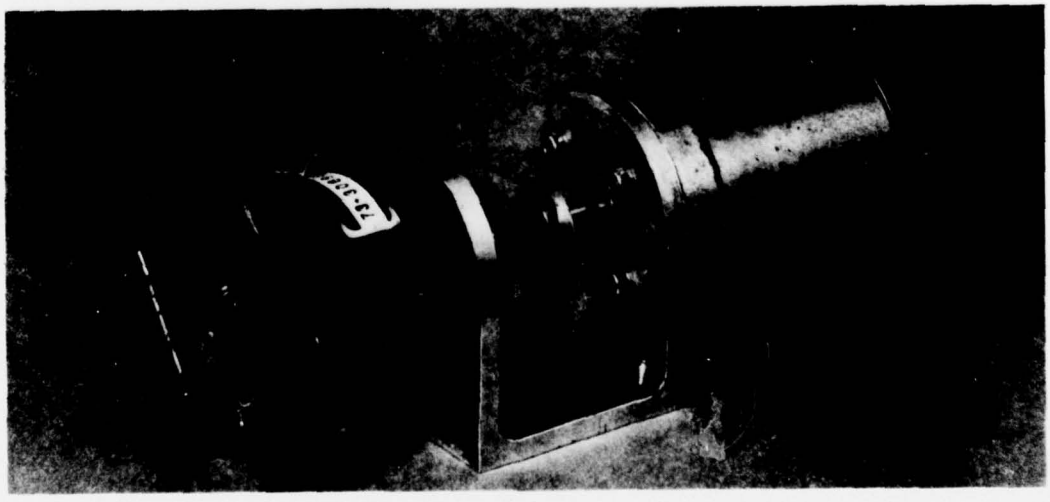


Figure 8. Pump, motor, and mounting bracket.

TABLE 1. RPM OF PUMP MOTOR WITH VARIOUS LOADS AND POWER SOURCES

Power source	Vacuum (mmHg)	Motor (A)	Motor (rpm)
12 VDC	0	0.48	2250
	70	0.60	2180
	200	0.86	2020
	300	1.00	1850
24 VDC	0	0.74	4800
	70	0.81	4800
	200	1.05	4500
	300	1.60	3680
28 VDC	0	0.82	5850
	70	0.90	5800
	200	1.10	5700
	300	1.50	5400

TABLE 2. MOTOR AND PUMP TEMPERATURE FLUCTUATIONS WHEN OPERATING IN INTERMITTENT-VACUUM MODE

Time (hours)	Ambient temp (^{o}F)	Motor temp (^{o}F)	Pump temp (^{o}F)
0	73.4	89.6	104.9
4	73.4	87.8	101.3
8	73.4	87.8	102.2
12	84.2	98.6	110.3
16	85.1	102.2	113.0
20	83.3	101.3	113.9
24	72.5	88.7	104.0

Another test was conducted to determine how long the suction pump would operate on continuous-vacuum mode using a 5-minute "on"/25-minute "off" cycle. The vacuum was adjusted to 500 mmHg, the maximum capability of the pump. The test was started at 0800, 10 July 1974, and was terminated at 0945, 13 September 1974. Actual running time of pump and motor was 231.4 hours during the test period. Table 3 depicts one 24-hour period of the test run.

To prevent cell polarity reversal during the recharge cycle, care must be taken not to completely discharge the self-contained battery pack when it is being used to operate the suction pump. Discharge should be discontinued when the battery pack voltage under load decreases to 11 volts. To fully charge the battery pack takes about 30 hours.

Laboratory tests were conducted to determine the time required to discharge a fully charged battery pack under load to 11 volts. Test results are given in Table 4.

Table 5 indicates the length of time the pump may be operated in the continuous vacuum mode before the battery-pack voltage under load decreases to 11 volts.

The USAFSAM multipurpose suction pump was placed in an environmental chamber and exposed for 2 hours to each of the following environmental conditions:

1. 8,000-ft (2.4-km) equivalent altitude
2. High temperature, + 120°F (54.4°C)
3. Low temperature, + 40°F (4.4°C)
4. High relative humidity, 95% at 75°F (23.9°C)
5. Low relative humidity, 20% at 70°F (21.1°C)

The suction pump was randomly and sinusoidally vibrated along each of the three mutually perpendicular axes. The vibration test was conducted in accordance with the Test and Evaluation Planning Guide for Aeromedical Evacuation Equipment, para. 3.3.1 (vibration test).

Sinusoidal Vibration: Displacement level of 0.05 inch from 5 to 31 Hz and acceleration level of 2.5G from 21 to 500 Hz. Each of the three mutually perpendicular axes were vibrated for 75 minutes.

Random Vibration: Acceleration power spectral density of $0.0023G^2$/Hz at 20 Hz, 6-dB/octave curve to $0.045\ G^2$/Hz at 90 Hz. Acceleration power spectral density of $0.045\ G^2$/Hz from 90 to 2,000 Hz. Minimum composite G, 9.0G rms. Each of the three mutually perpendicular axes were vibrated for 30 minutes.

TABLE 3. MOTOR AND PUMP TEMPERATURE FLUCTUATIONS WHEN OPERATING IN CONTINUOUS-VACUUM MODE

Time (hours)	Ambient temp (^{o}F)	Motor temp (^{o}F)	Pump temp (^{o}F)
0	73.4	113.0	104.0
4	72.5	113.0	103.1
8	77.9	117.5	104.0
12	82.4	123.8	113.0
16	83.3	125.6	113.9
20	81.5	124.7	113.0
24	75.2	113.0	102.2

TABLE 4. MOTOR PUMP OPERATING IN INTERMITTENT-VACUUM MODE FROM BATTERY PACK

Time (hours)	Load voltage	No load voltage
0	13.35	13.83
15	12.29	12.63
16	12.24	12.59
18	12.07	12.41
20	11.85	12.18
22	10.62	11.09

TABLE 5. MOTOR PUMP OPERATING IN CONTINUOUS-VACUUM MODE FROM BATTERY PACK

Time (hours)	Battery-pack voltage	Vacuum (mmHg)
0	13.40	200
0.5	12.59	200
1	12.39	200
1.5	12.15	200
2	11.90	200
2.5	11.30	200
3	10.28	198

For compliance with MIL-STD-461A, the multipurpose suction pump was tested for electromagnetic compatibility, radiated and conducted emissions, in both the intermittent- and continuous-vacuum mode as the pump was operated from 115 VAC, 60 Hz; 115 VAC, 400 Hz; 28 VDC; and self-contained battery pack.

The pump was placed in a rapid decompression chamber. With the pump operating, the chamber was decompressed from ground-level pressure to 8,000-ft (2.4-km) equivalent altitude within 2 minutes; then from 8,000- to 35,000-ft (10.7-km) equivalent altitude in 0.2 second. Two decompression tests were run: (1) with the pump operating in continuous mode; and (2) with the pump operating in intermittent mode. After return to ground-level pressure, the pump was tested in all modes of operation.

OPERATIONAL TEST AND EVALUATION

In May 1975 one prototype USAFSAM suction pump was sent to the Aeromedical Evacuation Squadron (AES) at Travis Air Force Base, California, for trans-shipment to the 9th AES, Clark Air Force Base, Republic of the Philippine Islands. The 9th AES field tested the pump for 9 months, June 1975 through February 1976.

RESULTS

Results of tests conducted on the USAFSAM pump indicate that during the 192 days the pump and motor operated in the intermittent-vacuum mode with 12 VDC on the motor, the motor and pump temperatures averaged 15.8°F and 29.2°F higher, respectively, than the average ambient temperature. The pressure switch, which turns the pump motor on and off, operated over 2 million times during the test run without malfunctioning. When the test was terminated at the end of 192 days, the pressure switch and pump-motor module were still operating satisfactorily.

The suction pump was operated for 62 days in the continuous-vacuum mode, providing the maximum vacuum of 500 mmHg, with a 5-minute "on" and 25-minute "off" cycle. Actual running time for the pump and motor during this test was 231.4 hours. The motor and pump temperatures averaged 40.7°F and 29.6°F higher, respectively, than the average ambient temperature. At the end of the test the motor and pump were still operating satisfactorily.

From a fully charged battery the pump will operate 2.5 hours in the continuous-vacuum mode and 21 hours in the intermittent mode.

During and after temperature, altitude, relative humidity, rapid decompression, and vibration tests, the suction pump operated satisfactorily, meeting all design and operational specifications.

Electromagnetic compatibility (EMC) tests indicated that the radiated and conducted emissions generated by this suction pump did not exceed the limits specified by MIL-STD-461A. EMC tests were conducted with the pump operating both in the continuous-vacuum mode and in the intermittent mode. In each case the pump was tested while operating from 115 VAC, 60 Hz; 115 VAC, 400 Hz; 28 VDC; and the self-contained battery pack.

Results of the field test by the 9th AES, Clark Air Force Base, indicate that the USAFSAM multipurpose suction pump should be added to the medical equipment inventory because it meets the aeromedical-evacuation needs for a suction pump.

The field test also resulted in the following suggestions. The case could be smaller and have side securing handles and detachable lid. An electrical cord outlet in the case would allow the lid to be closed while the battery is being recharged. Large numbers on two sides of the collection bottle could make reading easier, also larger increment numbers between 0 to 200 mmHg on the vacuum gauge. If AC power is interrupted, the pump should change automatically from AC-power to self-contained battery-pack operation. A warning sign should be added to indicate that the unit can operate from its self-contained battery during an AC-power interruption, thus ensuring safety during aircraft refueling.

DISCUSSION

With minor modifications, the suction pump meets design and operational performance specifications. The complete unit, including carrying case, weighs 38 pounds and will operate from 115 VAC 50-400 Hz power, 12 or 28 VDC, or a self-contained battery pack. The unit contains the necessary power cable extensions, power cables, and power adapters to permit operation in hospitals, ambulances, helicopters, and aircraft. The unit provides intermittent vacuum in either 0-30 or 0-70 mmHg ranges. It also provides three ranges of continuous vacuum: 0-100, 0-250, or 0-500 mmHg.

CONCLUSIONS

The USAFSAM multipurpose suction pump provides a method for obtaining continuous and intermittent suction from one self-contained unit for use during aeromedical operations in multipurpose aircraft. The unit enables aeromedical crewmembers to provide suction as required for patients during flights and when enplaning or deplaning. The unit meets military standards for the aircraft environment and is therefore acceptable for use onboard aeromedical airlift aircraft.

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